

Hydraulics Updates to the IndianaDesign Manual

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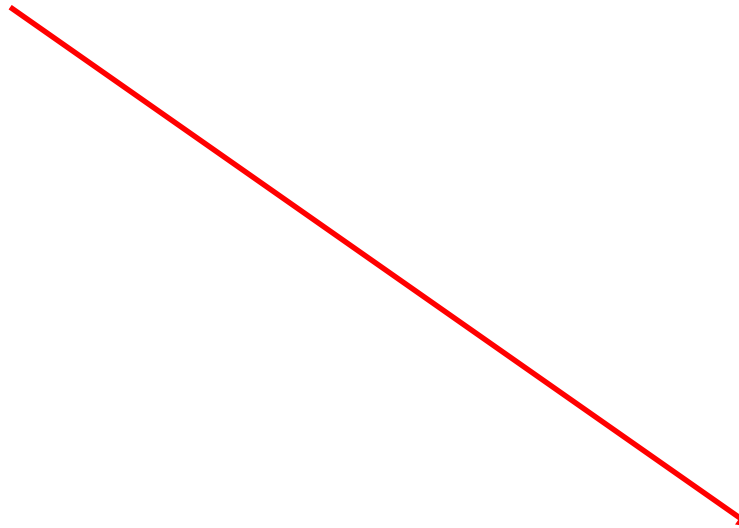
March 8, 2017




Updates to the IDM

How-to Information

Helpful set of presentations on the Office of Hydraulics website



 BUSINESS & AGRICULTURE RESIDENTS GOVERNMENT EDUCATION

Related Links and Documents

Design Guidance

- [Indiana Design Manual](#)
- [Standard Drawings](#)
- [Archived Project's Plan Request](#)
- [Permit Manual](#)
- [BIAS](#)
- [HEC-RAS Bridge and Scour Modeling Procedures](#)

Hydrology Links

- [NOAA Precipitation Frequency Estimates](#)
- [NOAA - Vertcon](#)
- [DNR Coordinated Discharges](#)
- [DNR Hydraulics Model Library](#)
- [DNR Peak Discharge Determination System](#)
- [DNR Floodplain Information Portal](#)
- [USGS Streamstats v3](#)
- [USDA NRCS Soil Surveys](#)
- [Purdue Regression](#)

Other Links and Forms

- [Field Data Form](#)
- [Safety Briefing Form](#)
- [INDOT Traffic Count Database System](#)

Past Presentations

- [Hydraulics Presentation - County Bridge Conference 2016](#)
- [Hydraulics Presentation - Bridge Hydraulics Parameters 2014](#)
- [Hydraulics Presentation - Storm Damage - Floating Culverts 2016](#)
- [Hydraulic Training Conference - February 7, 2017](#)
 - [IDM Updates](#)
 - [Pipe Liners](#)
 - [Small Structure Replacement](#)
 - [Drainage Area & Discharge Determination](#)
 - [Hydraulic Data - Bridges](#)
 - [Bridge Rehab Scour](#)

Updates to the IDM

Status of the current updates...



Updates to the IDM

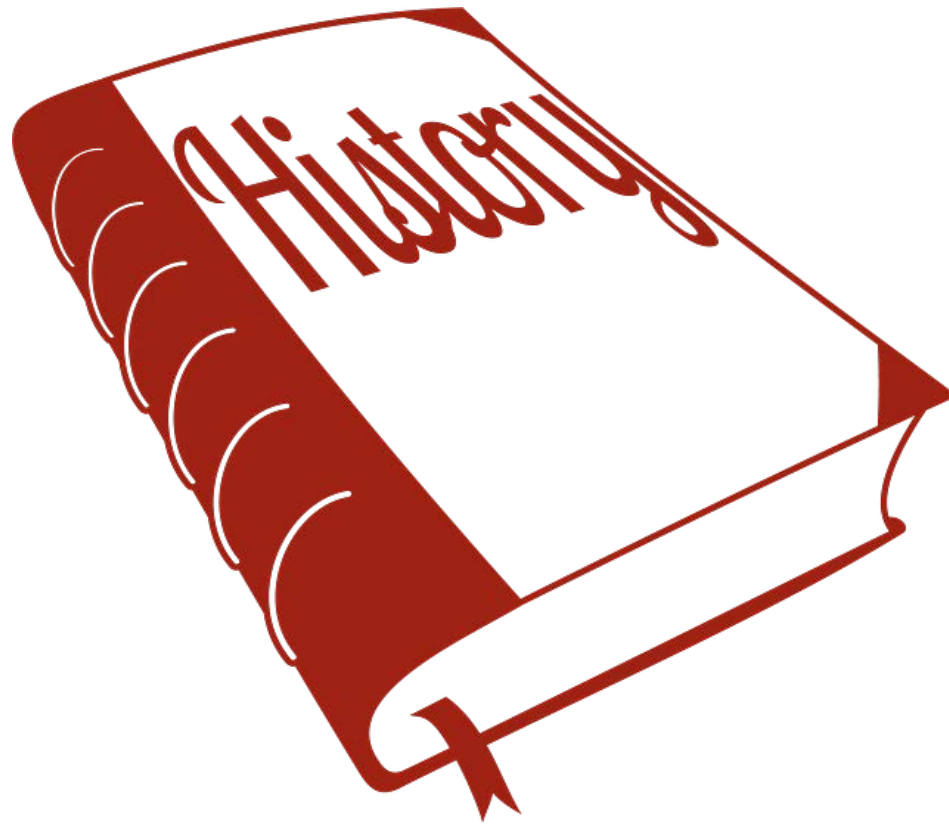
Bridge REPLACEMENT Updates...

ONE FOOT



Updates to the IDM

Bridge REPLACEMENT Updates...



Backwater...



First assess the existing backwater



Basic backwater criteria:

<i>If the existing backwater is...</i>	<i>The allowable backwater will be...</i>
> 3 feet	3 feet or less
Between 0.14 and 3 feet	Match or improve existing
Less than 0.14 feet	Up to 0.14 feet

This can be affected by other factors →

Backwater: Check velocity...

Requires judgment

Evidence of instability?

If the existing bridge is unstable, the average velocity in the proposed bridge waterway should be $\leq 1.5 \times$ the downstream channel velocity.

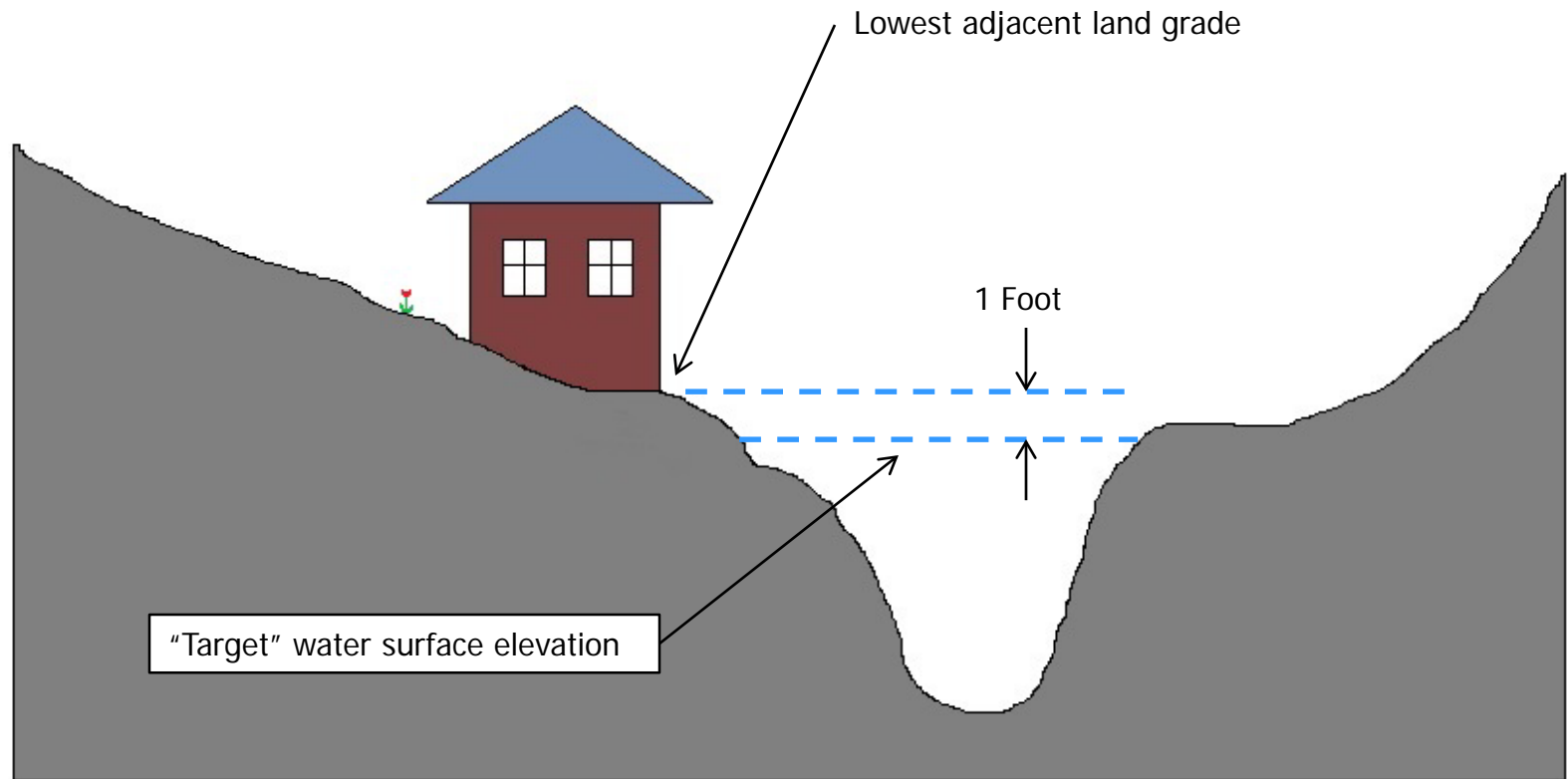


Updates to the IDM **Bridge Replacement**

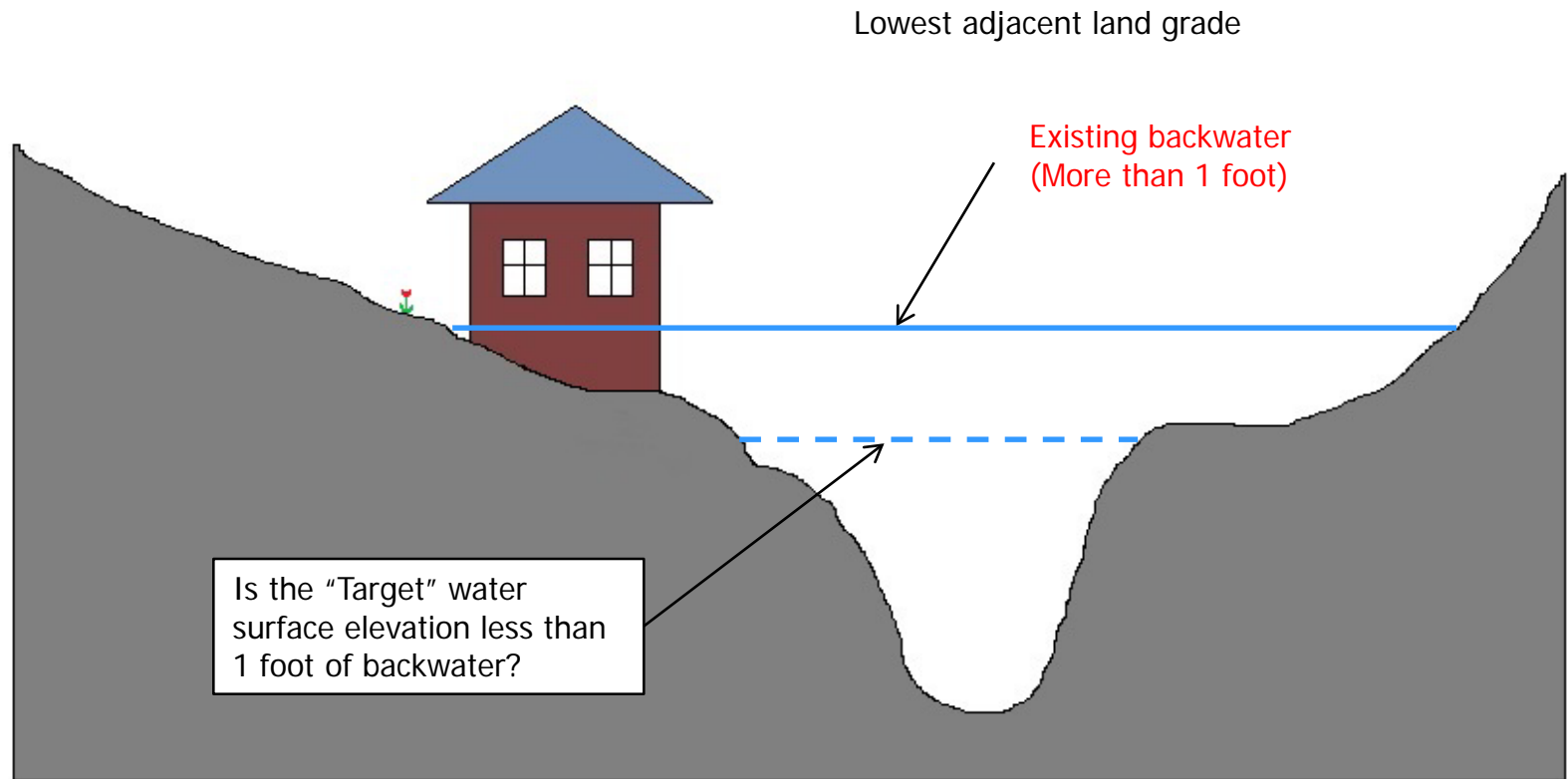
Backwater: U/S structures...



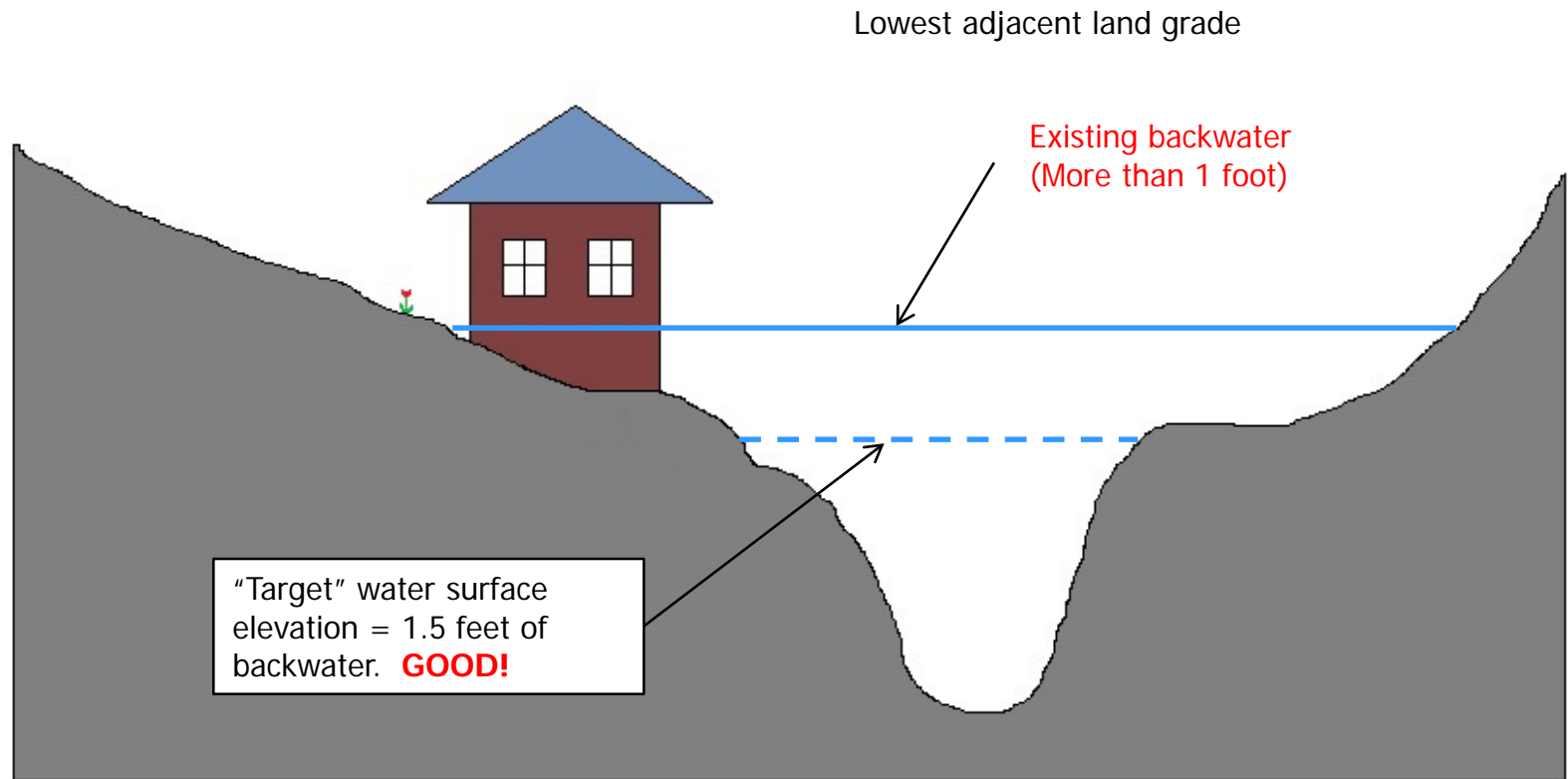
Backwater: U/S structures...



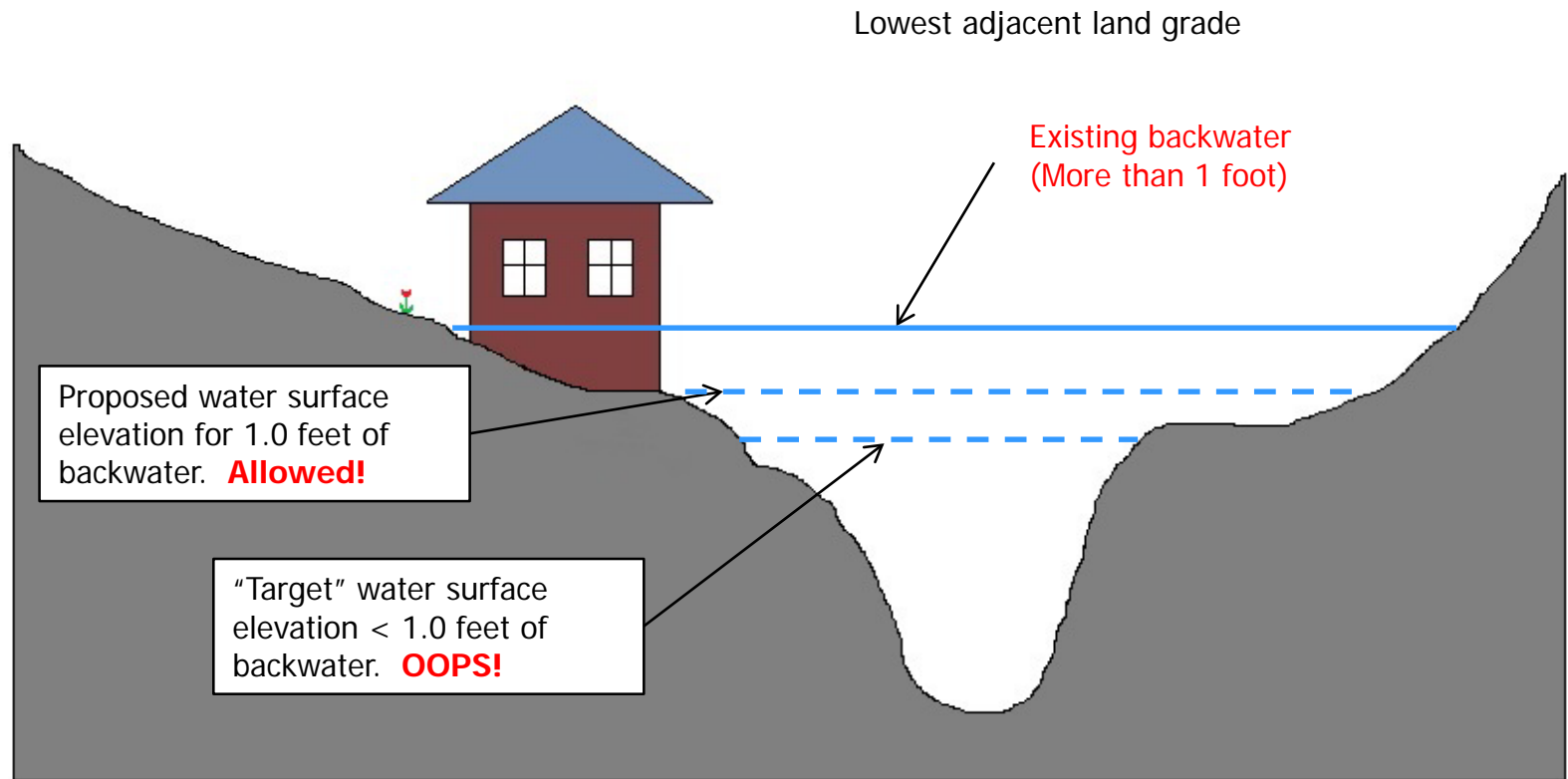
Backwater: U/S structures...



Backwater: U/S structures...

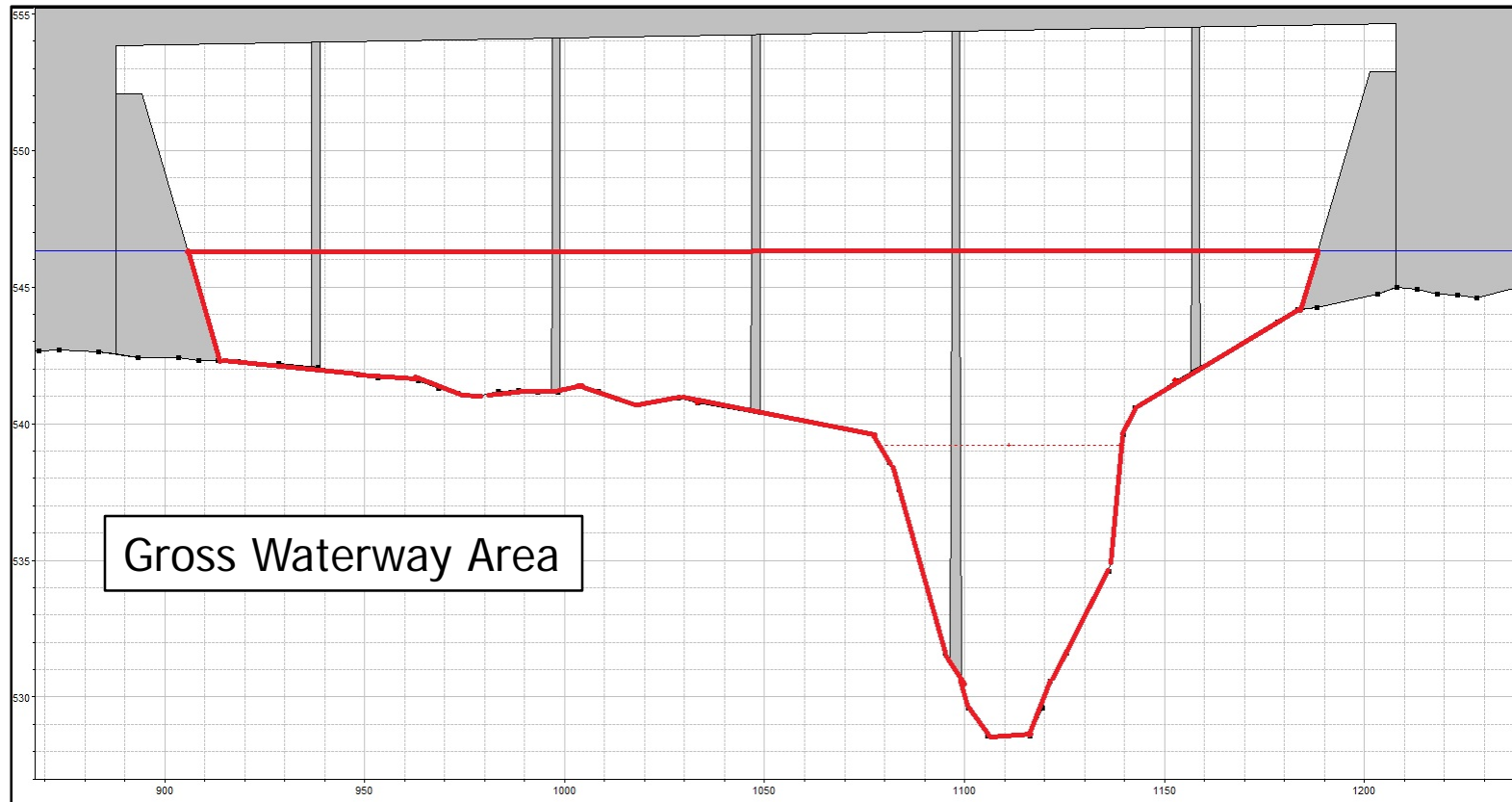


Backwater: U/S structures...



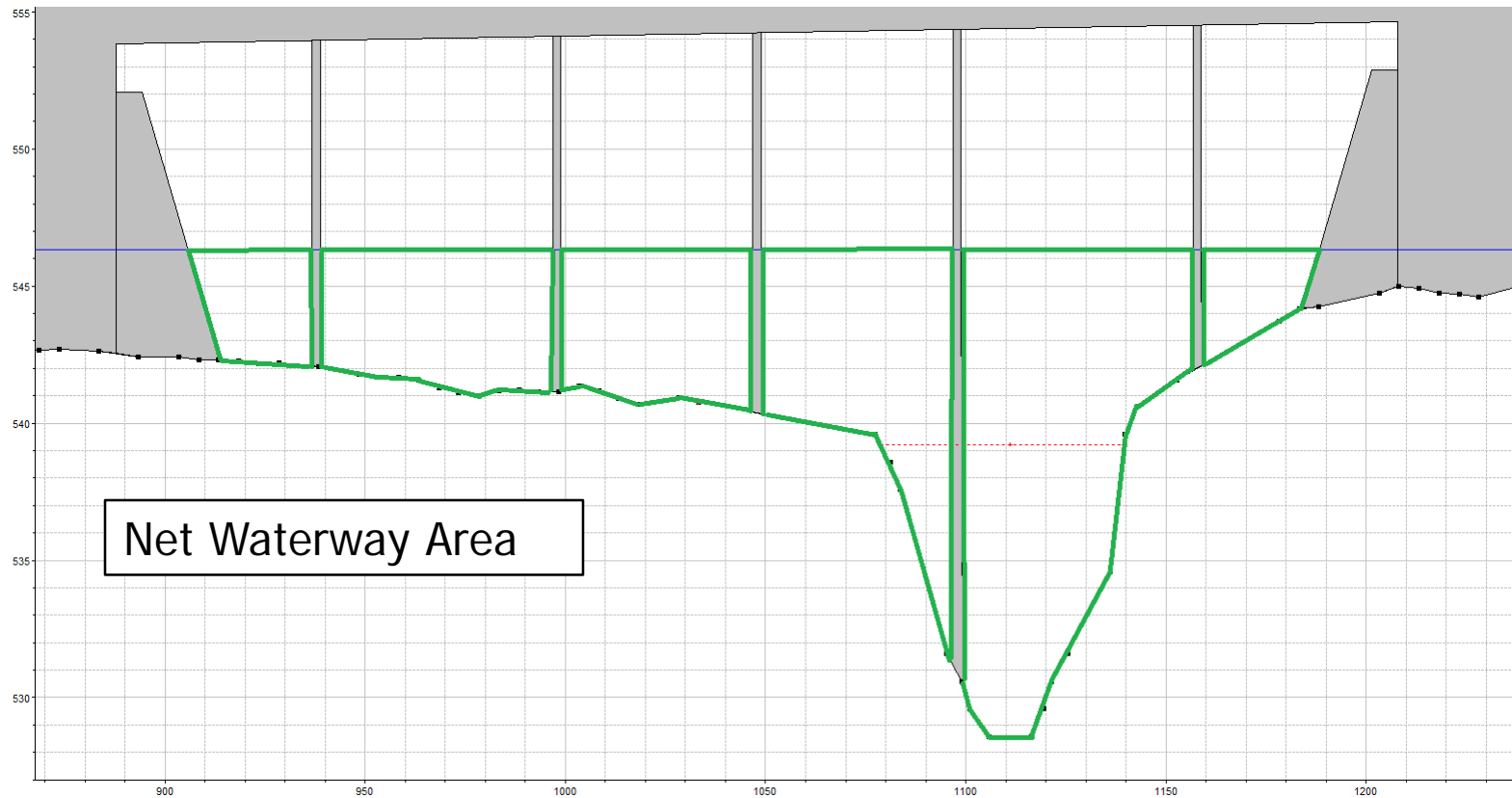
Updates to the IDM **Bridge Replacement**

Backwater: Waterway areas...



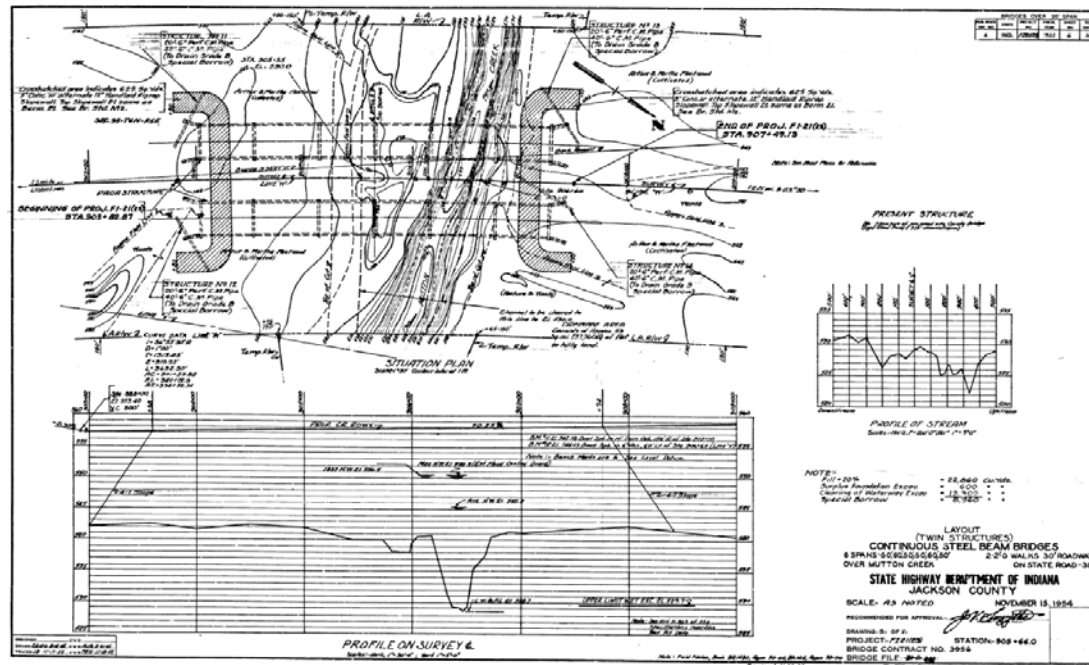
Updates to the IDM **Bridge Replacement**

Backwater: Waterway areas...



Updates to the IDM Bridge Replacement

Backwater: Waterway areas...



Request plans at: <http://www.in.gov/indot/2345.htm>



Other Criteria: Freeboard...



Current criteria:

Ideal is 2' or...
maybe 1' or...
maybe 3'

New criteria:

What do I
need to
achieve?

Other Criteria: Freeboard...

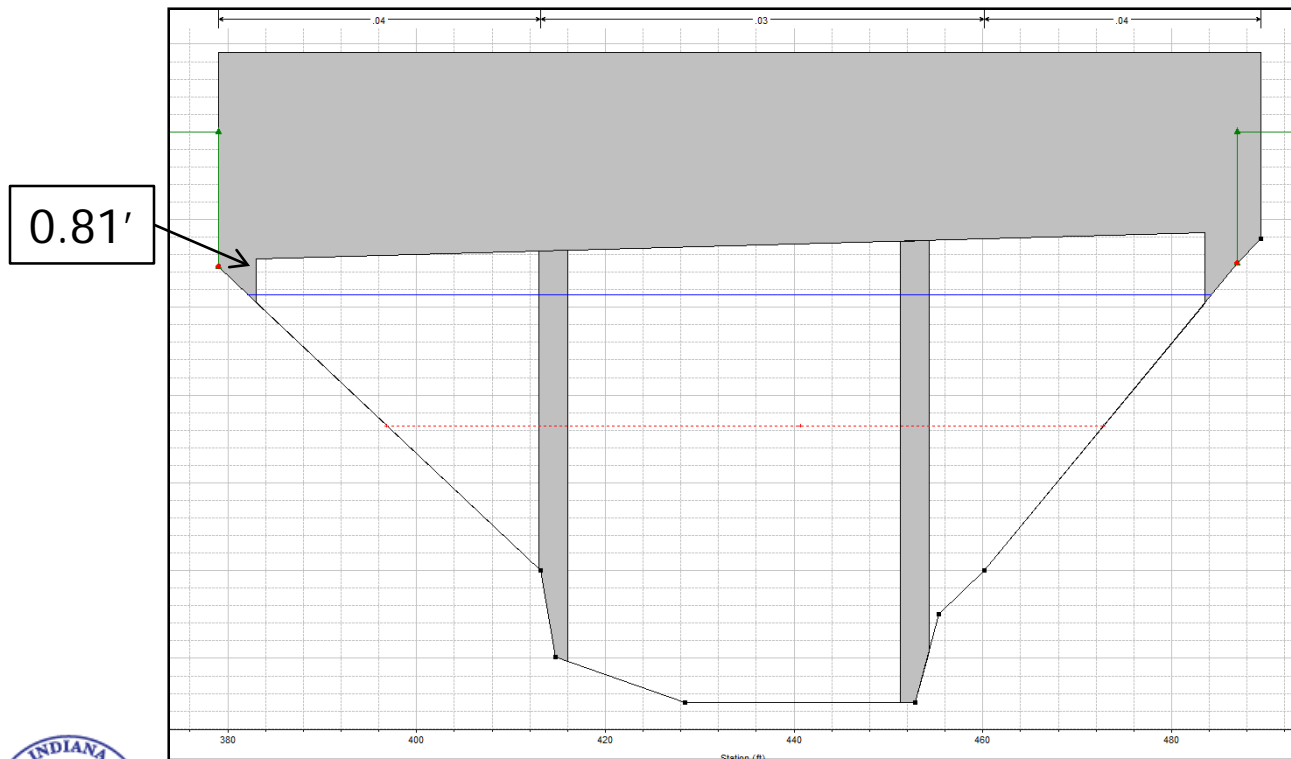
Goal: Meet the existing criteria

Three possibilities:

1. The existing low structures is above the goal
2. The existing low structure is in pressure flow
3. The existing low structure is above the 1% EP elevation, but no pressure flow

Other Criteria: Freeboard...

Matching existing freeboard

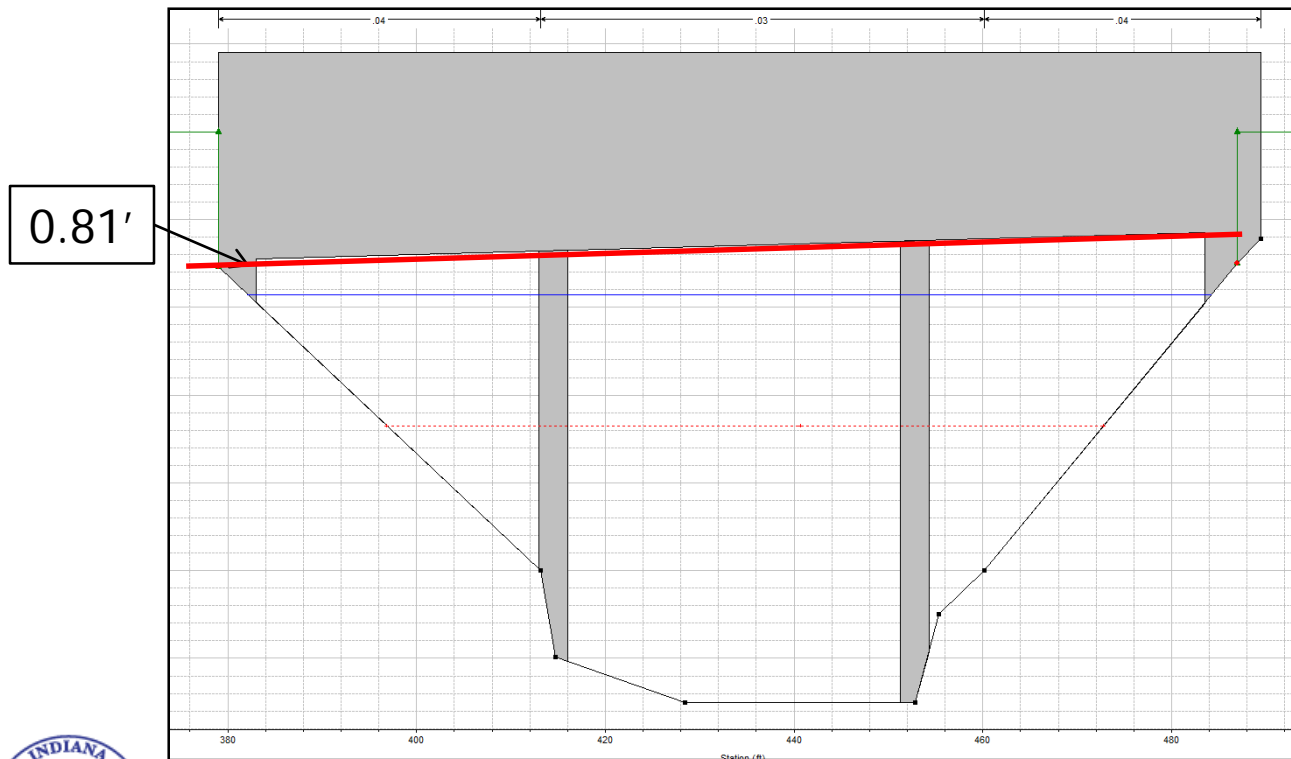


*Debris
issues?*

Yes: Meet
the current
criteria

Other Criteria: Freeboard...

Matching existing freeboard



*Debris
issues?*

Yes: Meet
the current
Criteria

No: Can
match the
PROFILE

Updates to the IDM Bridge Replacement

Two-Span Structures



Updates to the IDM

Culvert REPLACEMENT Updates...

Replacement in Kind...



Updates to the IDM

Culvert REPLACEMENT Updates...

~~Replacement in Kind...~~ Is now the main policy!



Updates to the IDM **Culvert Replacement**

~~Replacement in Kind...~~ Is now the main policy!

Backwater...



Proposed backwater can be as much as 3 feet *provided* is less than the existing backwater

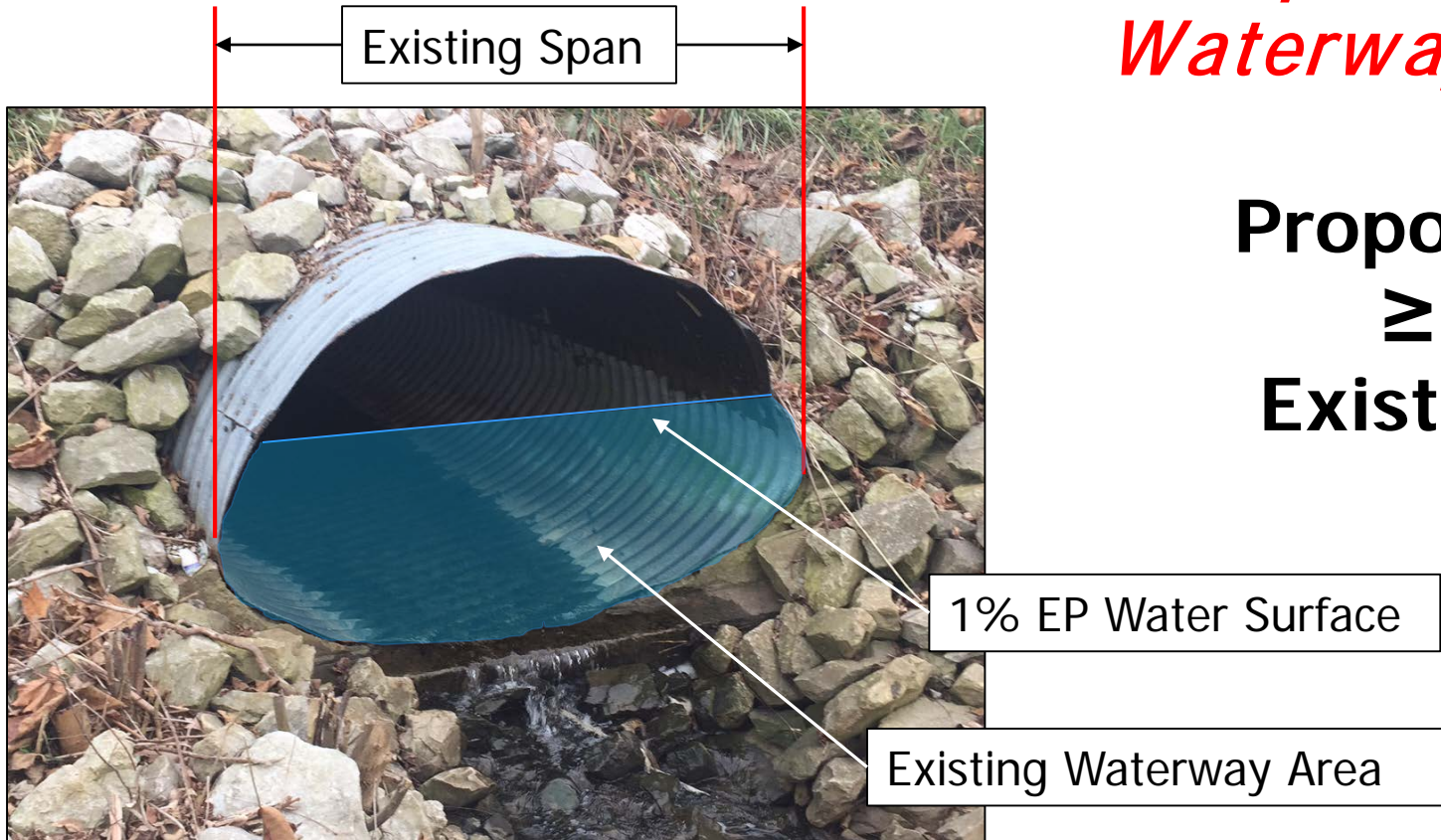


But what if an upstream structure would be affected? See the bridge design criteria...

Other Criteria...

*Span and
Waterway Area:*

**Proposed
≥
Existing**



Updates to the IDM **Culvert Replacement**

Other Criteria...

**Outlet Velocity \leq
1.5 x Channel Velocity**



*Does the pipe have
a scour issue?*

Other Criteria...



**Outlet Velocity \leq
1.5 x Channel Velocity**

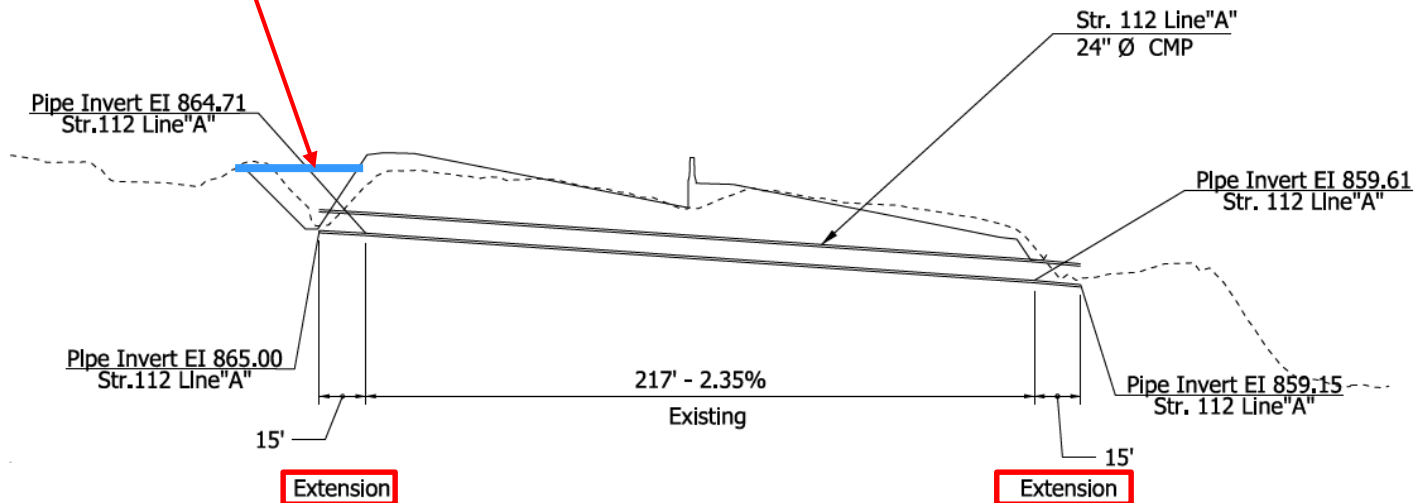
Exceptions:

- Minimum outlet velocity = 6.5 ft/sec
- 1 foot of backwater

Culvert Extension

If the culvert is extended, what happens to the headwater here?

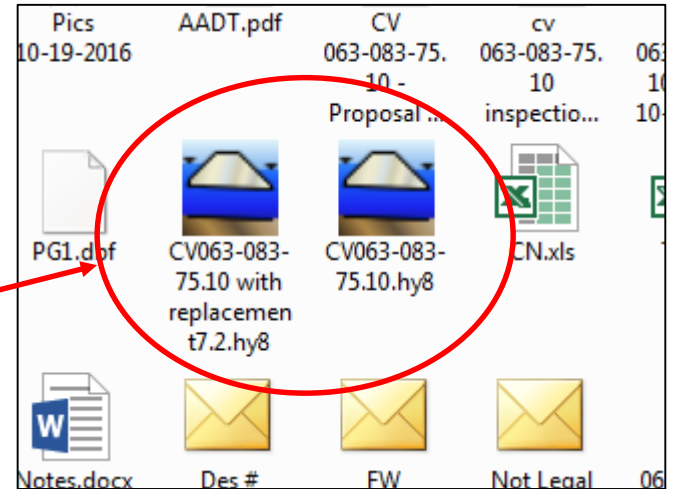
- The headwater elevation has to stay the same
- Remember: HEADwater, not BACKwater
- How to deal with that?



Updates to the IDM

Other Things...

When making a submittal, include the electronic files – and mention the version that is used.

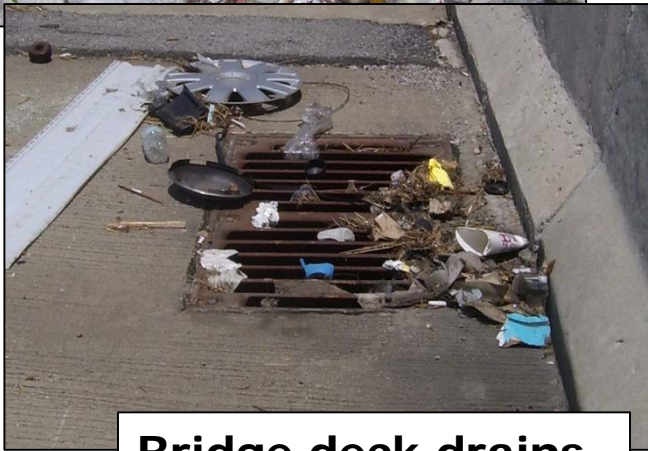


**Is there concern about downstream impacts?
Contact the Office of
Hydraulics.**



50% Clogging Factor...

REQUIRED



Bridge deck drains

NOT REQUIRED



Sags with
flanking inlets

Flanking Inlets...

Required for curb and gutter sections.

Required for median and side ditches unless there is a good place for the water to go.



Updates to the IDM

Pipe Cover

New set of standard drawings...
Cover is now based on pipe type and size

3" x 1" CORRUGATED ALUMINUM ALLOY PIPE-ARCH (RIVETED OR LOCK SEAM)													
HEIGHT OF COVER LIMITS (ft)													
CORNER RADIUS (in.)	SPAN (in.)	RISE (in.)	AREA (sft)	THICKNESS (in.)									
				0.060		0.075		0.105		0.135		0.164	
				MIN.	MAX.	MIN.	MAX.	MIN.	MAX.	MIN.	MAX.	MIN.	MAX.
8 (Min.) 18 3/4 (Typ.)	60	46	15.6			1.1	20.8	1.1	20.8	1.1	20.8	1.1	20.8
9 (Min.) 20 3/4 (Typ.)	66	51	19.3			1.1	20.9	1.1	20.9	1.1	20.9	1.1	20.9
12 (Min.) 22 7/8 (Typ.)	73	55	23.2			1.1	20.8	1.1	20.8	1.1	20.8	1.1	20.8
14 (Min.) 20 7/8 (Typ.)	81	59	27.4					1.2	17.1	1.2	17.1	1.2	17.1
14 (Min.) 22 5/8 (Typ.)	87	63	32.1					1.2	17.3	1.2	17.3	1.2	17.3
16 (Min.) 24 3/8 (Typ.)	95	67	37.0							1.2	17.1	1.2	17.1
16 (Min.) 26 1/8 (Typ.)	103	71	42.4							1.2	16.9	1.2	16.9
18 (Min.) 27 3/4 (Typ.)	112	75	48.0									1.3	16.5



Updates to the IDM

More to come...

Culvert Lining and more...

Find information on
the INDOT Hydraulics
website

<http://in.gov/indot/3595.htm>

The screenshot shows the Indiana Department of Transportation (INDOT) website. The top navigation bar includes links for MENU, IN.gov, BUSINESS & AGRICULTURE, RESIDENTS, GOVERNMENT, and EDUCATION. The main header features the Indiana Department of Transportation logo and name. The left sidebar contains a list of links under the heading 'INDOT HOME', including Travel Conditions, Current Programs, Doing Business with INDOT, Major Projects, Road & Bridge Investment, Public Involvement, Careers with INDOT, Media Room, Safety, Maintenance Operations, Traffic Operations, Resources, Asset Management, Multimodal, About INDOT, Accessibility & Non-Discrimination, and Contact INDOT. The main content area is titled 'HYDRAULICS' and 'Hydraulics'. It includes a description of the INDOT Hydraulics section, which designs or reviews all waterway projects. Below this, there are sections for 'Pipe Lining Design' and 'Policy Changes'. The 'Policy Changes' section is highlighted with a red box and contains a list of revisions to Hydraulics design guidance. A red arrow points from the URL 'http://in.gov/indot/3595.htm' to the 'Policy Changes' section.

INDOT HOME

- Travel Conditions
- Current Programs
- Doing Business with INDOT
- Major Projects
- Road & Bridge Investment
- Public Involvement
- Careers with INDOT
- Media Room
- Safety
- Maintenance Operations
- Traffic Operations
- Resources
- Asset Management
- Multimodal
- About INDOT
- Accessibility & Non-Discrimination
- Contact INDOT

INDOT > **About INDOT** > **Central Office** > **Bridges** > **Hydraulics**

HYDRAULICS

Hydraulics

The INDOT Hydraulics section designs or reviews all waterway projects including, but not limited to, bridges, culverts, storm sewers, and detention ponds along state roads, U.S. routes or interstates or local projects built with state or federal funds.

Pipe Lining Design

Pipe lining is a technique for maintaining existing corrugated metal pipes in which a smooth walled structure is installed within the existing pipe and grouted into place. This practice does remove water way area, but the roughness factor is reduced. Projects are analyzed to meet or better existing conditions and appropriate scour protection is installed to further protect the embankments for the typically higher velocities.

Another way for maintenance to prolong the life of a pipe is by paving the invert of the pipe. This process lines the floor of the existing pipe with approximately a five inch thick smooth concrete flooring. This application is useful if the floor of the pipe is deteriorating while the walls and top of the pipe are in satisfactory condition.

Policy Changes

The following list contains revisions in Hydraulics design guidance that may not be reflected in the Indiana Design Manual (IDM).

- All liner options should have the inverts of the pipes raised by the liner thickness. Backwater should then be calculated by taking the existing culvert's backwater and subtract the difference of the headwaters.
- HY-8 v.7.2 is currently the only version permitted for use by the INDOT Office of Hydraulics. The link to upload the software is on the [Active Design Memoranda](#) page under number 16-34.
- Jack and bore pipes as part of a culvert liner project under the interstate are required to have a minimum inner diameter of 18 inches.



THANKS

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